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OBSERVATIONS ON *TRIALEURODES PACKARDI* (MORRILL) IN A COMMUNITY GARDEN (HOMOPTERA: ALEYRODIDAE)

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Strawberry whitefly, *Trialeurodes packardi* (Morrill), is commonly associated with strawberry (*Fragaria ananassa*) in urban areas of the Sacramento Valley of California. In certain community gardens, strawberry is grown as either a "monoculture" (i.e., a given garden plot planted entirely in strawberry) or as part of a polyculture (i.e., a few strawberry plants mixed with other crops). Thus, *T. packardi* occurs on strawberry plants grown in both monocultures and polycultures. The purpose of the present study was to assess the influence of such crop-plant diversity on abundance of *T. packardi* in a community garden.

Materials and Methods

The study site was a community garden on the Davis Campus of the University of California. This site was previously an experimental orchard and was converted into a community garden during the early 1970's. The garden was composed of ca. 450, 21 m^2 plots. The experimental work was conducted from April 20 through July 6, 1977. Subsequent destruction of the gardens precluded further observations.

Fourteen gardens (referred to herein as plots) were chosen for study. Plots 1–7 were polycultures whereas plots 8–14 were strawberry monocultures. Crops grown in the polycultures during the course of the experiment are given in Table 1. Of these crops, apparently only strawberry is a suitable host for *T. packardi* (Russell, 1948, 1963). All plots were well cared for by the respective gardeners and none was treated with a chemical pesticide during the course of the study.

Plots were sampled weekly from April 20–July 6. A sample consisted of a careful inspection of the undersides of 10 randomly chosen leaves per plot. The number of adults and immatures of *T. packardi* was recorded. This procedure was carried out such that there was minimal disruption of the plants in question. All of the specimens collected from strawberry and submitted for determination were *T. packardi*. Greenhouse whitefly, *T. vaporariorum* (Westwood), infested numerous plants in the gardens but was never collected from strawberry.

Table 1. Crops grown in polycultural plots.

Crops	Plots						
	1	2	3	4	5	6	7
Number strawberry plants	26	7	10	9	9	8	16
English pea	X[a]	X[a]		X[a]		X[a]	
Tomato	X			X	X	X	X
Egg plant	X			X[b]	X	X[b]	
Pepper	X			X[b]	X		X[a]
Swiss chard	X					X[a]	
Onion	X		X	X	X	X	X
Beet	X			X			
Carrot	X					X	
Sweet corn		X					
Squash	X[b]	X		X[b]	X	X	X[b]
Artichoke			X				
Green bean	X[b]					X	
Lettuce					X	X	
Peanut	X[b]						
Cucumber	X[b]				X[b]	X[b]	
Broccoli				X[b]			
Lima bean				X[b]			

[a] Removed during the experiment.
[b] Added during the experiment.

Results and Discussion

Population density of *T. packardi* in the polycultures contrasted markedly with that in the monocultures (Fig. 1). During the study, mean densities (i.e., whiteflies/10 leaves) in the polycultures ranged from 1–90, 0–19, 2–34, 0–18, 0–32, 0–29 and 0–39 in plots 1–7, respectively. In the 7 monocultures, mean whitefly density during the study ranged from 0–7, 0–2, 0–1, 0–5, 0–4, 0–3 and 0–2, respectively. As the ranges in mean whitefly density were generally similar for both monocultural and polycultural plots, average densities (N = 7) for each set of plots were computed and these are plotted in Figure 1. Mean density for the season was 12.74 whiteflies/10 leaves in the polycultures compared to 0.69 in the monocultures. Mean percent leaves infested during the season was 34.5% in the polycultures compared to 5% in the monocultures. These results are also consistent with previous observations made in the same community garden during 1976 (see Ehler, 1978). In that study, mean whitefly density (adults + immatures) was 21.9/10 leaves (55.2% leaves infested) in polycultures compared to 1.7/10 leaves (9.8% leaves infested) in monocultures. Furthermore, whitefly populations exhibited instability in the polycultures and stability in the monocultures.

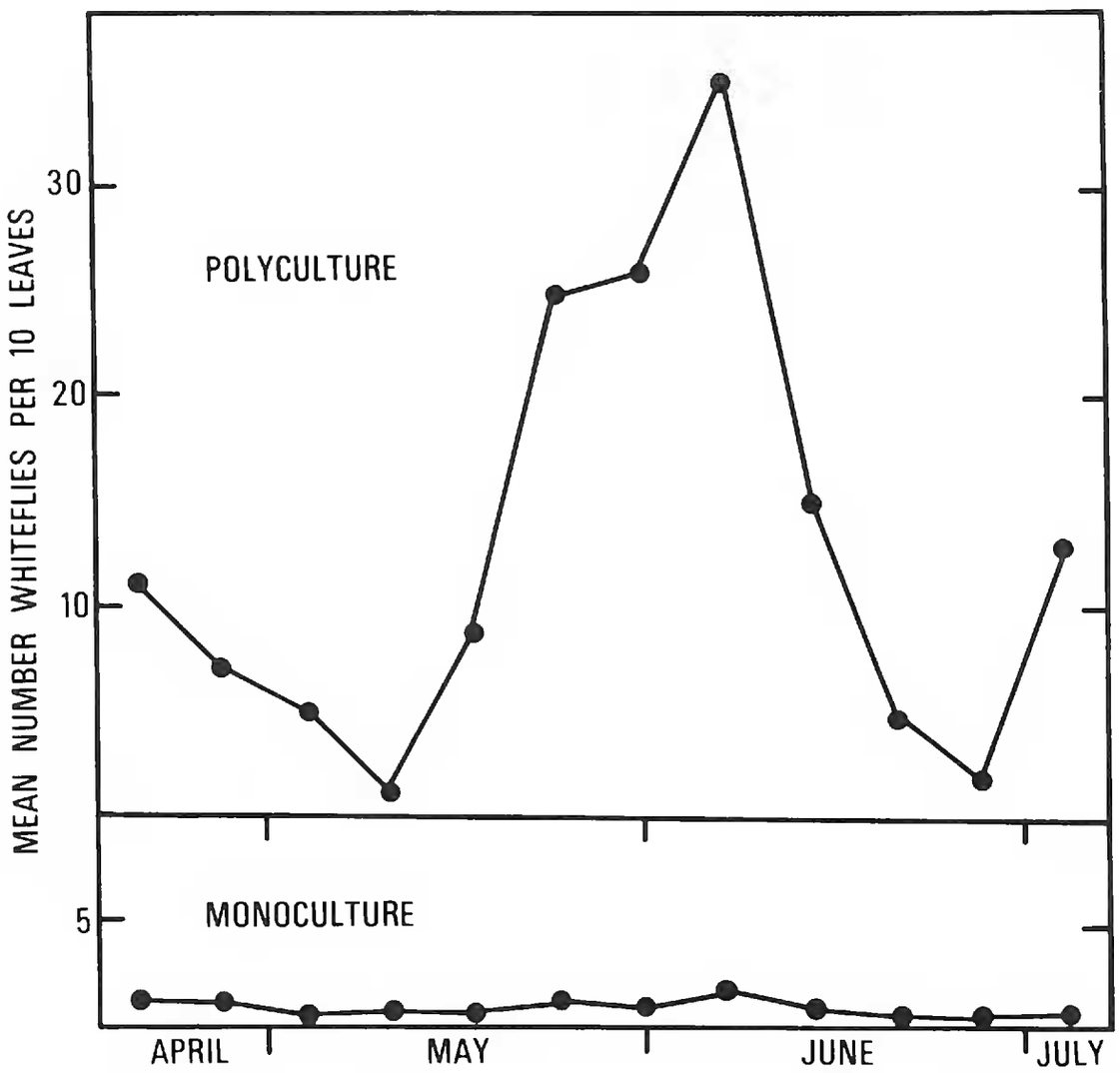

Fig. 1. Population trends of *Trialeurodes packardi* on strawberry grown in polyculture vs. monoculture.

A number of hypotheses can be postulated to account for the empirical dichotomy documented here. Perhaps the most obvious hypothesis would be that, in polycultures, whiteflies build up on other crop plants and subsequently invade the strawberry plants, thus resulting in higher population densities than in monocultures. However, this does not appear likely because, according to Russell (1948, 1963), strawberry whitefly has not been recorded from any of the crops (other than strawberry) utilized in the present study. Furthermore, the whiteflies which infest these crops are characteristically *T. vaporariorum*. Another hypothesis would involve differential action by natural enemies; however, I was unable to detect such activity by natural enemies of strawberry whitefly in these plots. Some additional research regarding the role of natural enemies is warranted however. A more plausible hypothesis at present involves differential habitat suitability. That is, strawberry whitefly apparently prefers a more open habitat such as that provided by a few, rather widely spaced strawberry plants in the mixed plantings. Conversely, the more densely planted monocultures are less suitable habitats.

The following empirical evidence is submitted in support of the latter hypothesis. On June 2, 1978, I sampled 9 densely planted strawberry monocultures which also had a few, widely spaced plants along the edges. In each case, 20 leaves were examined: 10 each from the interior plants and from the marginal plants. Samples from the interior of these monocultures yielded an average of 1.1 ± 0.4 whiteflies/10 leaves (7.8% leaves infested) compared to 13.4 ± 3.3 whiteflies/10 leaves (56.7% leaves infested) among more widely spaced plants along the edges. Thus, it appears that strawberry plants grown in polyculture are quite suitable for strawberry whitefly such that "boom and bust" cycles in population density result; in strawberry monocultures, the habitat is apparently much less suitable for the insect and only a marginal amount of reproductive success occurs. In this regard, only 5.2% of all the individuals observed in the 7 monocultures were nymphs compared to 46.4% in the 7 polycultures.

The view that diversity begets stability or lessens pest problems has been critically assessed by numerous recent authors; these include theoretical treatments (e.g., May, 1973; Gilpin et al., 1976), more practical accounts (e.g., van Emden and Williams, 1974; Litsinger and Moody, 1976) and combinations of both (e.g., Murdoch, 1975; Way, 1977). From such accounts, it becomes apparent that (1) the value of crop diversity in agroecosystems is open to question and (2) the view that diversity begets stability or lessens pest problems is an excessive generalization. The results of the present study attest to the latter conclusion—i.e., the results were precisely the opposite of what the theory predicts. In many ways, the diversity in the polycultures was irrelevant; the more important factor apparently was habitat suitability as influenced by plant density and spacing, etc. However, this hypothesis is in need of additional empirical verification.

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